

| REPORT DOCUMENTATION PAGE | | | Form Approved OMB No. 0704-0188 | |
|--|--|---|------------------------------------|----------------|
| Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503. | | | | |
| 1. AGENCY USE ONLY (Leave blank) | 2. REPORT DATE 1-3-95 | 3. REPORT TYPE AND DATES COVERED Final | | |
| 4. TITLE AND SUBTITLE A Kilohertz Femtosecond Ti:Sapphire Regenerative Amplifier | | 5. FUNDING NUMBERS | | |
| 6. AUTHOR(S) N. Peyghambarian and B. McGinnis | | <div style="text-align: center;"> DTIC ELECTE FEB 23 1995 SDG </div> | | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Optical Sciences Center University of Arizona Tucson, AZ 85721 | | | | |
| 8. PERFORMING ORGANIZATION REPORT NUMBER | | 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U. S. Army Research Office P. O. Box 12211 Research Triangle Park, NC 27709-2211 | | |
| 10. SPONSORING/MONITORING AGENCY REPORT NUMBER | | 11. SUPPLEMENTARY NOTES The view, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation. | | |
| 12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited. | | 12b. DISTRIBUTION CODE | | |
| 13. ABSTRACT (Maximum 200 words) To have capabilities in the near-infrared, we proposed to develop a Ti:S regenerative amplifier operating at one kilohertz. This amplifier was developed to amplify the pulses from our femtosecond Ti:S laser oscillator to the 2-3 μJ /pulse energy level. This type of energy in a femtosecond pulse allowed us to generate a broadband ($\approx 1000 \text{ \AA}$) in the near-infrared for spectroscopic studies of III-V-based semiconductors. <div style="text-align: right;">DTIC QUALITY INSPECTED 4</div> | | | | |
| 14. SUBJECT TERMS Ti:S regenerative amplifier | | 15. NUMBER OF PAGES 2 | | 16. PRICE CODE |
| 17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED | 18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED | 19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED | 20. LIMITATION OF ABSTRACT UL | |

19950216 017

We proposed to build a kilohertz femtosecond titanium-doped sapphire (Ti:S) regenerative amplifier system. The recent development of femtosecond laser pulses from a Ti:S laser oscillator provided us with a new stable source for femtosecond spectroscopy of near-infrared semiconductors. While visible laser dyes have provided good results for femtosecond laser systems and broadband continuum generation, infrared pulse generation from laser dyes has proven less reliable, with a limited tuning range. We built a system capable of producing modest energy pulses ($2-3 \mu\text{J}$) at a kilohertz repetition rate for higher average power and better signal-to-noise statistics. We incorporated the latest developments in all solid-state pumped lasers to produce an efficient compact system with improved stability, reliability and longevity. This amplified energy was sufficient to generate a broadband source ($\approx 1000 \text{ \AA}$) of femtosecond duration, which is necessary for studying the absorption features of III-V semiconductor structures. We performed pulse propagation studies in MQW waveguide structures. The tunability of the Ti:S laser system allowed us to study the effects of propagation of femtosecond pulses in waveguides over a broad spectral range. We intend to further study the gain dynamics of a variety of bulk and multiple quantum well semiconductor laser diodes. Since the range of gain spectra varies tremendously with growth composition and structure of the laser diode, it is necessary to have a wavelength flexible femtosecond source to continue these studies.

Diagram illustrating the schematic of a Q-switched Nd:YAG laser resonator. The main resonator consists of a flat high reflector and a $\text{Ti:Al}_2\text{O}_3$ saturable absorber. A pump beam enters from the top right, passing through a mode-matching telescope and a $f = 10 \text{ cm}$ focussing lens. A Pockels cell is located in the main resonator. A regenerative loop is formed by a glass flat, a mode-matching telescope, an optical isolator, and a variable λ $\lambda/2$ plate, which is coupled to the main resonator via a polarizer. The regenerative loop includes a flat high reflector and a $f = 5 \text{ cm}$ high reflector. The output is labeled "regen output".

Figure 1. Schematic of Ti:S regenerative amplifier.

| | |
|---------------------|--|
| Accession For | |
| NTIS CRA&I | <input checked="checked" type="checkbox"/> |
| DTIC TAB | <input type="checkbox"/> |
| Unannounced | <input type="checkbox"/> |
| Justification _____ | |
| By _____ | |
| Distribution / | |
| Availability Codes | |
| Dist | Avail and / or Special |

A-1

